

What is claimed is:

1. A film-forming surface reforming method comprising the steps of:

bringing a gas or an aqueous solution containing
5 any one selected from the group consisting of ammonia, hydrazine, amine, amino compound, and their derivative into contact with a film-forming surface before an insulating film is formed on the film-forming surface of a substrate; and

10 bringing a gas or an aqueous solution containing any one selected from the group consisting of hydrogen peroxide, ozone, oxygen, nitric acid, sulfuric acid, and their derivative into contact with the film-forming surface.

15 2. A film-forming surface reforming method according to claim 1, wherein any one of a silicon oxide film and a silicon nitride film is exposed on the film-forming surface.

20 3. A film-forming surface reforming method according to claim 2, wherein any one of a semiconductor layer and a metal layer in addition to any one of the silicon oxide film and the silicon nitride film is exposed on the film-forming surface.

25 4. A film-forming surface reforming method according to claim 1, wherein the amine is a compound having a chemical formula NR_nH_{3-n} ($n=1,2,3$, R: alkyl group).

5. A film-forming surface reforming method according to claim 1, wherein the amino compound is a compound having a chemical formula RNH_2 (R: organic group).

5 6. A semiconductor device manufacturing method comprising the steps of:

 bringing a gas or an aqueous solution containing
any one selected from the group consisting of ammonia,
hydrazine, amine, amino compound, and their derivative
10 into contact with a film-forming surface before an
insulating film is formed on the film-forming surface
of a substrate;

 reforming the film-forming surface by bringing a
gas or an aqueous solution containing any one selected
15 from the group consisting of hydrogen peroxide, ozone,
oxygen, nitric acid, sulfuric acid, and their
derivative into contact with the film-forming surface;
and

 forming an insulating film on the reformed film-
20 forming surface.

7. A semiconductor device manufacturing method comprising the steps of:

 exposing a film-forming surface of a silicon
nitride film to a hydrogen peroxide water; and

25 forming an insulating film on the film-forming
surface after the film-forming surface is exposed to
the hydrogen peroxide water.

8. A semiconductor device manufacturing method comprising the steps of:

exposing a film-forming surface of a silicon oxide film to an aqueous solution containing any one
5 of NO_2^- and NO_3^- ; and

forming an insulating film on the film-forming surface after the film-forming surface is exposed to the aqueous solution.

9. A semiconductor device manufacturing method
10 according to claim 8, wherein a mixed solution containing an ammonia (NH_3), a hydrogen peroxide (H_2O_2), and a pure water (H_2O) is employed as the aqueous solution.

10. A semiconductor device manufacturing method
15 according to claim 8, wherein a nitric acid (HNO_3) is added to the aqueous solution.

11. A semiconductor device manufacturing method comprising the steps of:

preparing a mixed solution containing an ammonia
20 (NH_3), a hydrogen peroxide (H_2O_2), and a pure water (H_2O);

heat-insulating the mixed solution at a predetermined temperature for a predetermined time so that NO_2^- and NO_3^- concentrations in the mixed solution
25 are set to a desired concentration;

exposing a film-forming surface of a silicon oxide film to the mixed solution after the heat-

insulating; and

forming an insulating film on the film-forming surface after the film-forming surface is exposed to the mixed solution.

- 5 12. A semiconductor device manufacturing method according to any one of claims 6, 7, 8, and 11, wherein the insulating film is a silicon-containing insulating film which is formed by a thermal chemical vapor deposition employing a reaction gas that
- 10 contains an ozone-containing gas and a tetraethylorthosilicate.